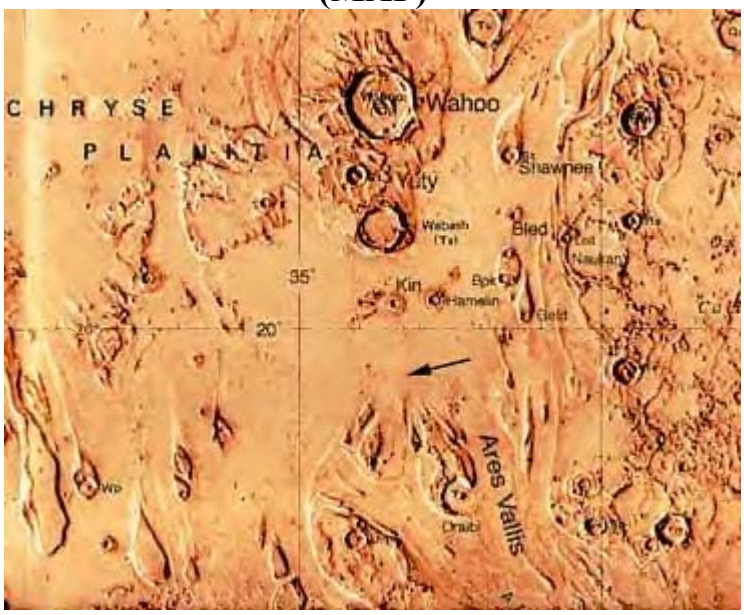
Mapping Team Role in Arizona

(MAP)



http://athena.cornell.edu/popups/mars_facts/pathfinder4.html
Map of Mars surface

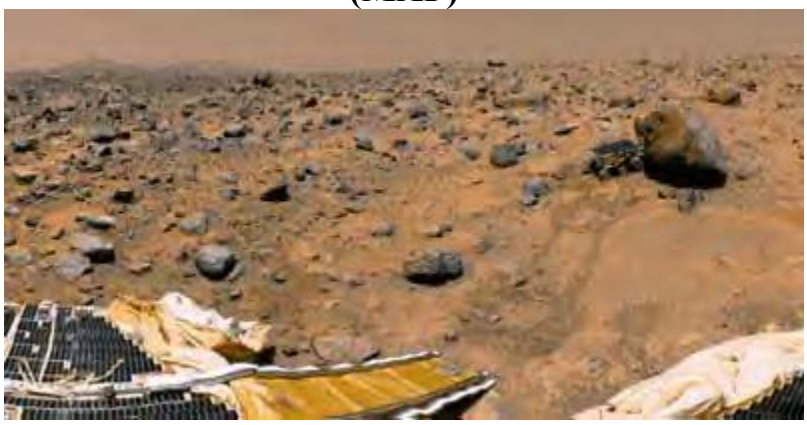
Your Mission:

While the rest of your team is back in Arizona calibrating the Rover, you will travel to Mars to create a scale map of the Martian terrain on graph paper. Of course scientists don't actually travel to Mars before sending Rover's there. (If we could do this, what would be the point of using a Rover?) Instead, they use satellite images to create maps. Be as precise as possible given time constraints. You will need to devise a plan for making approximations, because you will not have time to meticulously map each feature. Be sure to include any obstacles the rover may encounter. Once your map is complete, return to Arizona and work with COM and CAL to calibrate the rover's movements and compare them to the scale of your map. Once you have finished, answer the following questions in your **Team Logbook**.

Arizona Mapping Logbook Questions:

1. What was your measurement strategy? (Did you use floor tiles or other markers?)
2. What units are you using for measurement?
3. How accurate are your measurements?
4. How precise do you think they need to be? (Talk to your calibration team.)
5. Look at your map. What is the scale of your map?
6. Can you identify regions that might be difficult for your rover to navigate through?
7. What are the most important features on your map for the rover?

Mapping Team Role on Mars
(MAP)



http://athena.cornell.edu/popups/mars_facts/pathfinder1.html
Mars Landing Site

Your Mission:

Return to Mission Control, and launch the Rover. You may not show the map of Mars to the Rover at any time. Next, view the Mars terrain from a remote location (i.e. WebCam). Compare the image you see on the screen with your map. Your teacher will signal you to show you the sample site on Mars by waving his/her arms in the air. Plot it on your map while the Rover is traveling to Mars. Once your Rover has landed, and signaled you by waving its arms, work with CAL and COM to plot the path that the Rover will take to reach the sample site. While CAL and COM assemble the command sequence, mark the path on your map. Once the Rover begins to move, you will need to make sure it is staying on track. Remember, time is of the essence! You want to be the first team to reach the sample.

Rules on Mars

- The Rover may not see the map at any time.
- You may not leave Mission Control at any time.

Relevance:

NASA uses maps extensively for Earth and space science. All landing sites are mapped to the best of NASA's ability before the arrival of the rovers. Much of NASA's imagery is eventually turned into maps of the environment.

Communications Team Role in Arizona

(COM)

http://fido.jpl.nasa.gov/index14_sodamountain.html

Your Mission:

You must determine how many commands the rover can reliably execute in each command sequence. There are a set number of commands that the rover can execute. The commands list is given below. You will write these commands on index cards and put them in the order you want them executed for each command sequence. The command sequence is also given. Every time you give a set of commands, the sequence must be followed. If the rover fails to accurately execute a set of commands, it will shut down until a new command sequence is received. This can cost your team valuable time. Make a **chart** in your **Team Logbook** to show each command sequence, whether or not it was successful, and the time taken to execute the commands. Then answer the questions at the bottom of this page in your **Team Logbook**.

Commands (Write on index cards)

Turn (right or left, number of degrees)
Forward (number of steps)
Back (number of steps)
Bend (at waist)
Unbend (at waist)
Extend (right or left) Arm (angle)
Retract (right or left) Arm
Grasp (with right or left hand)
Lift arms above head

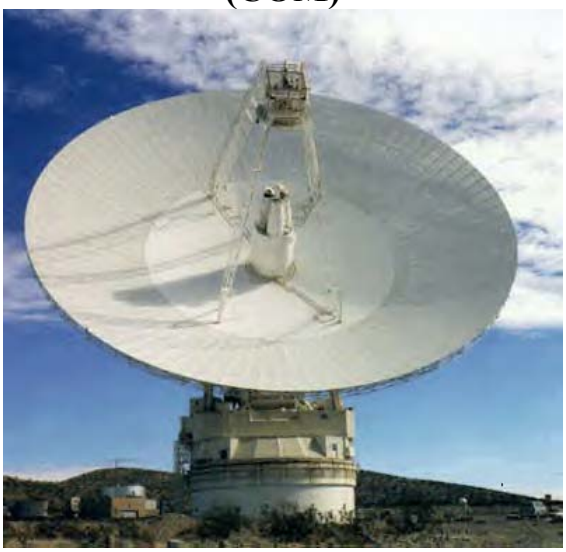
Command Sequence

a. COM touches rover's shoulder
b. COM: Hello (rover name)
c. ROV: Hello
d. COM reads the command sequence
e. ROV repeats the sequence
f. Steps d and e are repeated until the rover gets it right
g. COM: Correct (rover name). Goodbye.

Arizona Communication Logbook Questions:

1. How many commands can your rover remember?
2. Does it make a difference if you try to say the sequence fast or slow?
3. Does telling your rover to move Forward 10 get the same results as Forward 5 twice? How close are the results, in both time and distance? (Talk to the calibrations team!)
4. How long does it take you to move the rover across the room?
5. Is it faster to take your rover over obstacles or around them?

Communications Team Role on Mars
(COM)



(from mars site, have to search to find exact page)

Your Mission:

Once the Rover has landed on Mars, you will need to work with MAP and CAL to assemble a command sequence to be sent to the rover. Use what you learned during the Arizona activity to help you make wise decisions about your command sequence (ex. Which way will the Rover go if given the command "turn left 90 degrees"?). Once you have assembled the command sequence on the index cards, you can begin sending signals to the rover, making adjustments as necessary. You will act as the signal, by carrying the command sequences to the remote location of the rover. Use the same sequence from the Arizona Test Phase. After you say *goodbye*, you must return to Mission Control before another sequence can be sent. Remember, time is of the essence! You want to be the first team to reach the sample.

Rules on Mars

- COM must walk, not run
- COM may repeat the command sequence as many times as necessary until the rover repeats the sequence correctly.
- The next command sequence cannot be sent to Mars until the "active" COM team member returns. If this rule is violated, the offending team must wait until all the other teams have completed one sequence before sending the next command.
- COM must leave Mars immediately after saying goodbye to the rover.
- SEE ALSO- SAFE-HOLD rules (on Rover Team Role on Mars Worksheet)

Relevance:

Developing a communications strategy is part of every NASA mission, from both a logical and technical perspective.

Calibration Team Role in Arizona

(CAL)

http://fido.jpl.nasa.gov/index5_sodamountain.html

Your Mission:

You are responsible for measuring the performance of the rover as COM delivers commands. Listen as COM gives commands and measure the distance traveled by the rover. Copy the **log** below into your **Team Logbook**, and record the measurements of the rover's movements. Once you have completed your log, you will need to make a **graph,** in your **Team Logbook**, comparing the number of steps to the distance traveled. Then answer the questions at the bottom of this page in your **Team Logbook**.

What units are you using? _____

	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
1 Step					
2 Steps					
3 Steps					
4 Steps					
5 Steps					

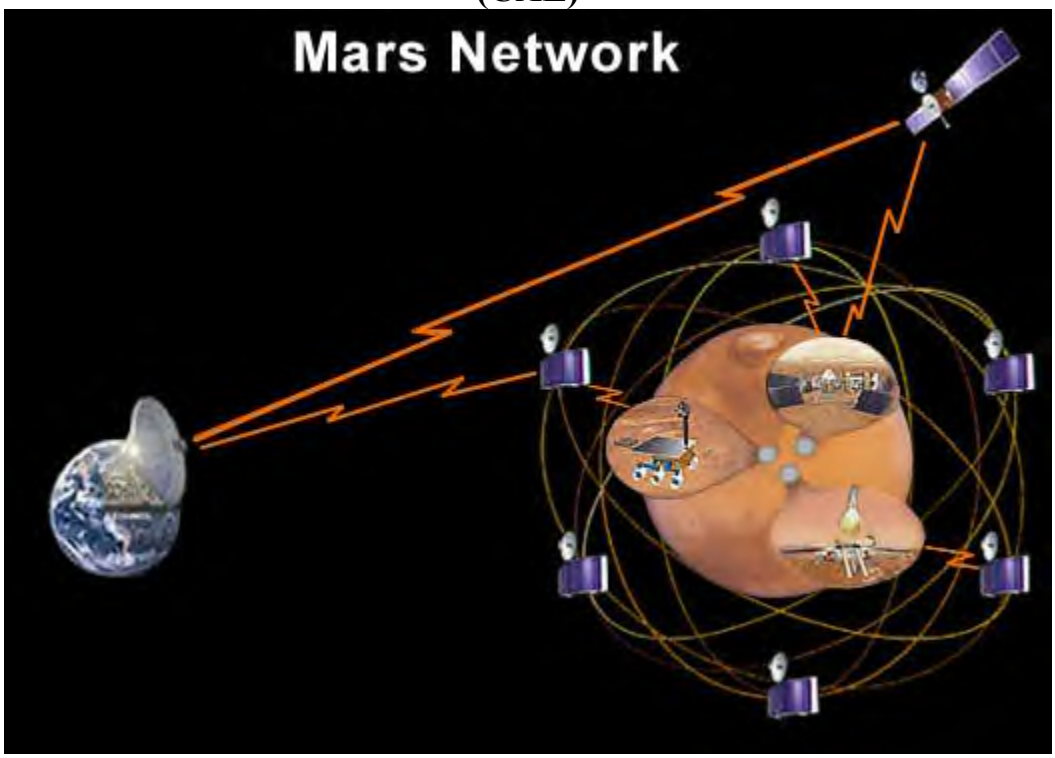
Graph your results. If your independent (x) axis is # of steps, What should your dependent (y) axis be?_____

Arizona Calibration Logbook Questions:

1. What is your measurement strategy? (from the toe, left foot, right foot, etc.)
2. How accurate are your measurements?
3. How precise do you think they need to be? (Talk to your mapping team!)
4. Look at your graph. What is the relationship between number of steps and distance traveled? Estimate how far the rover will go in 10 steps.

Calibration Team Role on Mars

(CAL)



http://mars.jpl.nasa.gov/technology/communications/communications01.html

Your Mission:

Once MAP returns from Mars with the completed map of the terrain, you will work together to compare the map with the remote view of the terrain. You should calibrate the size of the Rover's steps and directions of its movements with the map (ex. How many Rover steps equals 1 square on the graph paper?) Once the Rover has landed, and you have decided on the best possible path to the Mars sample, work with COM to create a command sequence. Use what you learned during the Arizona Test Run to help you make wise decisions about how many steps or changes of direction the Rover should execute at one time. Remember, time is of the essence! You want to be the first team to reach the sample.

Rules on Mars

- CAL never leaves Mission Control post.

Relevance:

Every scientific instrument must be calibrated so that scientists can relate the output of the instrument to the physical world.

Rover Role in Arizona

(ROV)

from fido site

Your Mission:

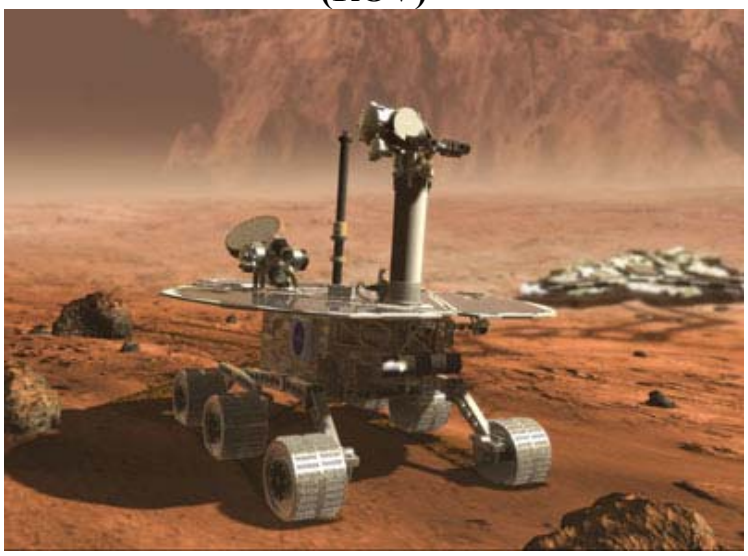
As the Rover, your mission is to follow the command sequences given to you as precisely as possible, without making any adjustments on your own, while blindfolded. While you are blindfolded, you will need to trust your team members, and follow their commands. Remember, you are a robot, and you don't have any "on board intelligence". That means you can't make any moves unless a command is given in the correct manner. You cannot communicate with your team members, except when repeating back a command sequence to COM. Once you have completed the Arizona Test Run, answer the following question in your **Team Logbook**.

Arizona Calibration Logbook Questions:

1. What was the most difficult part of being a Rover? Why was this part difficult?

Rover Role on Mars

(ROV)



Taken from student activity sheets document

Your Mission:

While you are on your way to Mars, your team members will compare the map of Mars with the remote view. During this time, you will be sent to a holding station close to Mars, where you will review the Rules on Mars. Once you are blindfolded, and have landed on Mars, your teacher will tell you to signal Mission Control that you have landed by waiving your arms in the air. This is the start of the competition. You must correctly repeat a command sequence to COM before making any moves. If you make a mistake while executing the command sequence you will be ordered to shut down. You must then go into "safe hold" (you do not move), until a new command sequence is delivered. You will continue to execute command sequences until you, or another rover, reach the sample site. Remember, time is of the essence! You want to be the first team to reach the sample.

Rules on Mars

- Rover must remain blindfolded at all times.
- If the over makes a mistake, the monitor places the rover into SAFE-HOLD. *The rover must stop immediately and wait until the next set of commands is delivered.
- If a rover runs into another rover, the monitor places the rover in SAFE-HOLD (*see above). The other rover gets to go first, even if it takes that team longer to get the commands to their rover.
- A rover may not move parts of the terrain; it must go around. If a rover runs into a piece of terrain, the monitor places the rover into SAFE-HOLD (*see above).
- If a rover is driven out of the view, the monitor returns the rover to the edge of the field of view (facing out) and places the rover in SAFE-HOLD (*see above).
- The rover that picks up the sample first and "lifts arms overhead" is the winner.

Relevance:

NASA deploys remotely operated robots and rovers as part of its missions to explore the Universe and search for life, and inspire the next generation of explorers...

...as only NASA can.